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(54) Invention Name: The method of production of aluminum-titanium alloys with the direct electrolysis of the carbon anode containing titanium oxide

(57) Abstract:

This invention involves a method of production of aluminum-titanium alloys with the direct electrolysis of the carbon anode containing titanium oxide. The first aim of this invention is that the carbon anode containing titanium oxide is produced. The formula of the materials is in light of the weight percentage as following: the petroleum coke after forging ranges from 73% to 81%, the coal tar pitch from 17% to 25% and the powder of titanium oxide from 0.5% to 5%. The materials are put in the kneading pot that can heats for kneading for 30 up to 45 minutes producing the paste material. Then the paste material is processed and shaped into the carbon anode containing titanium oxide of required specifications. The latter is roasted and produced in accordance with the technology of the routine production of carbon anode. The second aim is that the carbon anode containing titanium oxide well roasted is installed in the aluminum electrolysis bath and the aluminum-titanium alloys are produced with the direct electrolysis. The performance of the products of this invention is significantly better than that of the melting method. The powder of titanium oxide can replace the costly titanium metals in this method. This method not only doesn't need multiple melting, but also overcomes the problems that there are the aliquation and the uneven distribution in production of the intermediate aluminum-titanium alloys. Furthermore, it also solves the technological problems that the current efficiency is low in the production with the electrolysis method and it is difficult to manage the electrolysis bath.

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## Claims

What is claimed is

1. A method of production of aluminum-titanium alloys with the direct electrolysis of the carbon anode containing titanium oxide. Its characteristics are that firstly the carbon anode containing titanium oxide is produced. The formula of the materials is in light of the weight percentage as following: the petroleum coke after forging ranges from 73% to 81%, the coal tar pitch from 17% to 25% and the powder of titanium oxide from 0.5% to 5%. The formulated materials are put in the kneading pot that can heats for kneading for 30 up to 45 minutes producing the paste material. Then the paste material is processed and shaped into the carbon anode containing titanium oxide of required specifications. The latter is roasted and produced in accordance with the technology of the routine production of carbon anode. The second step is that the carbon anode containing titanium oxide well roasted is installed in the aluminum electrolysis bath and the aluminum-titanium alloys are produced with the direct electrolysis.

## Description

The method of production of aluminum-titanium alloys with the direct electrolysis of the carbon anode containing titanium oxide

1. Field of Technology

This invention involves a technology of production of the aluminum-matrix alloys with the direct electrolysis, especially a method of production of aluminum-titanium alloys with the direct electrolysis of the carbon anode containing titanium oxide.

2. Background of Technology

There are primarily two types of technology for production of the aluminum-titanium alloys at present. The first type is the production of the aluminum-titanium intermediate alloys by melting the pure aluminum and the pure titanium while the second type is the production of the intermediate aluminum-titanium alloys with the method of the aluminum thermal reduction melting method and with the materials such as the pure aluminum, the pure titanium salt and titanium oxide. Besides, the third type is the production of the intermediate aluminum-titanium alloys with the direct addition of titanium oxide in the aluminum electrolysis bath. The content of titanium generally ranges from 1% to 5% (the weight percentage) in the intermediate aluminum-titanium alloys produced with the three methods mentioned above. It is necessary to melt the pure aluminum and the intermediate aluminum-titanium alloys again into the aluminum-titanium alloys required by the user of the manufacturers when they need the aluminum-titanium alloys. There are the shortcomings such as the long process (multiple melting is required), the high-energy consumption during the melting and the high production cost for all the three types of technology. The third method is that titanium oxide is put into the aluminum electrolysis and the aluminum-titanium alloys are produced with the direct electrolysis. This method makes the management of the normal production of the aluminum electrolysis bath very difficult with the severe aliquation of the titanium in the aluminum solution and the low current efficiency.

3. Content of Invention

This invention aims at solving the problem mentioned above and developing a method of production of aluminum-titanium alloys with the direct electrolysis of the carbon anode containing titanium oxide. The first aim of this invention is that the carbon anode containing titanium oxide is produced. The formula of the materials is in light of the weight percentage as following: the petroleum coke after forging ranges from 73% to 81%, the coal tar pitch from 17% to 25% and the powder of titanium oxide from 0.5% to 5%. The formulated materials are put in the kneading pot that can heats for kneading for 30 up to 45 minutes producing the paste material. Then the paste material is processed and shaped into the carbon anode containing titanium oxide of required specifications The latter is roasted and produced in accordance with the technology of the routine production of carbon anode. The second aim is that the carbon anode containing titanium oxide

well roasted is installed in the aluminum electrolysis bath and the aluminum-titanium alloys are produced with the direct electrolysis. There are the characteristics such as the simple method, the short flow process and the low production cost. The powder of titanium oxide that is cheap and easy to get can replace the costly titanium metals in this method. This method not only doesn't need multiple melting, but also overcomes the problems that there are the aliquation and the uneven distribution in production of the intermediate aluminum-titanium alloys. Compared with the method that titanium oxide is put into the electrolysis bath for the direct electrolysis of the intermediate aluminum-titanium alloys, it also solves the technological problems that the loss of flying titanium oxide is big, the current efficiency is low in the production and it is difficult to manage the electrolysis bath. The performance of the products of this invention is significantly better than that of the melting method.

4. Mode of Implementation in details

Further explanation is given in details for the invention with the following implementation cases.

Implementation Case One

Firstly, the carbon anode containing titanium oxide is produced. The formula is in light of the weight percentage as following: 81% of the petroleum coke after forging, 17% of the coal tar pitch and 2% of the powder of titanium oxide. Weight 2.49 Kg of the petroleum coke after forging, 0.51 Kg of the coal tar pitch and 0.06 Kg of the powder of titanium oxide. Put 3.06 Kg of the formulated materials into the kneading pot that can heat for kneading for 30 minutes. 3.06 Kg of the paste material is produced. Process and shape this 3.06 kg of the paste material into three raw anode cylinders containing titanium oxide. The cylinder is 60 mm in diameter and 150 mm in height. Then put the anode cylinders are put into the roasting furnace for roasting. The roasting temperature is up to 1200 °C. Preserve the heat for four hours and then cool down to the room temperature. The carbon anode containing titanium oxide is produced. The physical and chemical properties of the carbon anode manufactured with the addition of 2% of the powder of titanium oxide and without the powder of titanium oxide are explained in Table 1.

Table 1

| Index of properties | Resistivity | Compression pressure | Titanium dioxide | Volume density |
|---|---|---|---|---|
| TiO % | μΩm | MPa | mg / cm$^2$·h | g /cm$^3$ |
| 0% | 63 | 32 | 54.1 | 1.57 |
| 2% | 57 | 36 | 33 | 1.57 |

Secondly, the aluminum-titanium alloys are produced with the direct electrolysis of the carbon anode containing titanium oxide after well roasted. The carbon anode with 2% of titanium oxide is employed and is installed in the small type electrolysis bath. The aluminum-titanium alloys with 0.24% of titanium is produced with the controlled temperature at 950°C, 4.1 volt of the bath voltage, 4.1 cm of polar distance and with 3.7% of aluminum oxide in the cryolite.